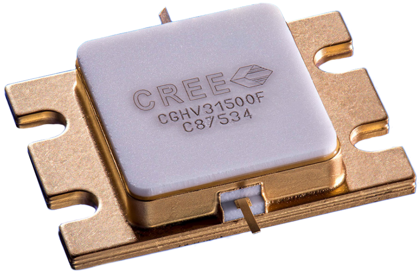
CGHV31500F

500 W, 2.7 - 3.1 GHz, 50-Ohm Input/Output Matched, GaN HEMT for S-Band Radar Systems

Description

CGHV31500F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV31500F ideal for 2.7 - 3.1 GHz S-Band radar amplifier applications. The transistor is supplied in a ceramic/metal flange package, type 440226.



PN: CGHV31500F
Package Type: 440226

Typical Performance Over 2.7-3.1 GHz (T_C = 25˚C) of Demonstration Amplifier

Parameter	2.7 GHz	2.9 GHz	3.1 GHz	Units
Output Power	650	705	506	W
Gain	12.1	12.5	11.8	dB
Drain Efficiency	70	68	58	%

Note: Measured in the CGHV31500F-AMP application circuit, under 100 µs pulse width, 10% duty cycle, P_{IN} = 46 dBm

Features

- 2.7 - 3.1 GHz Operation
- 650 W Typical Output Power
- 12 dB Power Gain
- 65% Typical Drain Efficiency
- 50 Ohm Internally MatcheD
- <0.3 dB Pulsed Amplitude Droop

Large Signal Models Available for ADS and MWO

RoHS COMPLIANT

Absolute Maximum Ratings (not simultaneous)

Parameter	Symbol	Rating	Units	Conditions
Pulse Width	PW	500	µs	
Duty Cycle	DC	10	%	
Drain-Source Voltage	V_{DSS}	150	Volts	25˚C
Gate-to-Source Voltage	V_{GS}	-10, +2	Volts	25˚C
Storage Temperature	T_{STG}	-65, +150	˚C	
Operating Junction Temperature	T_J	225	˚C	
Maximum Forward Gate Current	I_{GMAX}	80	mA	25˚C
Maximum Drain Current[1]	I_{DMAX}	24	A	25˚C
Soldering Temperature[2]	T_S	245	˚C	
Screw Torque	τ	40	in-oz	
Pulsed Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.22	˚C/W	100 µsec, 10%, 85˚C , P_{DISS} = 376 W
Case Operating Temperature	T_C	-40, +125	˚C	

Notes:
[1] Current limit for long term, reliable operation
[2] Refer to the Application Note on soldering at wolfspeed.com/rf/document-library

Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1] (T_C = 25˚C)						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V_{DC}	V_{DS} = 10 V, I_D = 83.6 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	V_{DC}	V_{DS} = 50 V, I_D = 0.5 A
Saturated Drain Current[2]	I_{DS}	62.7	75.5	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BR}	125	–	–	V_{DC}	V_{GS} = -8 V, I_D = 83.6 mA

Notes:
[1] Measured on wafer prior to packaging
[2] Scaled from PCM data

Electrical Characteristics Continued...

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
RF Characteristics[3] (T_C = 25˚C, F_0 = 2.7 - 3.1 GHz unless otherwise noted)						
Output Power at 2.7 GHz	P_{OUT1}	473	630	–	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Output Power at 2.9 GHz	P_{OUT2}	555	725	–	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Output Power at 3.1 GHz	P_{OUT3}	473	630	–	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Gain at 2.7 GHz	G_{P1}	–	12.1	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Gain at 2.9 GHz	G_{P2}	–	12.5	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Gain at 3.1 GHz	G_{P3}	–	11.8	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Drain Efficiency at 2.7 GHz	D_{E1}	57	68	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Drain Efficiency at 2.9 GHz	D_{E2}	54	67	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Drain Efficiency at 3.1 GHz	D_{E3}	50	62	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Small Signal Gain	S21	11.25	14.5	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 10 dBm
Input Return Loss	S11	–	-15	-5.25	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 10 dBm
Output Return Loss	S22	–	-5	-3	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 10 dBm
Amplitude Droop	D	–	-0.3	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Output Stress Match	VSWR	–	5:1	–	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm Pulsed

Notes:
[3] Measured in CGHV31500F-AMP. Pulse Width = 100 µS, Duty Cycle = 10%

Typical Performance

Figure 1. CGHV31500F S-Parameters
V_{DD} = 50 V, I_{DQ} = 0.5 A

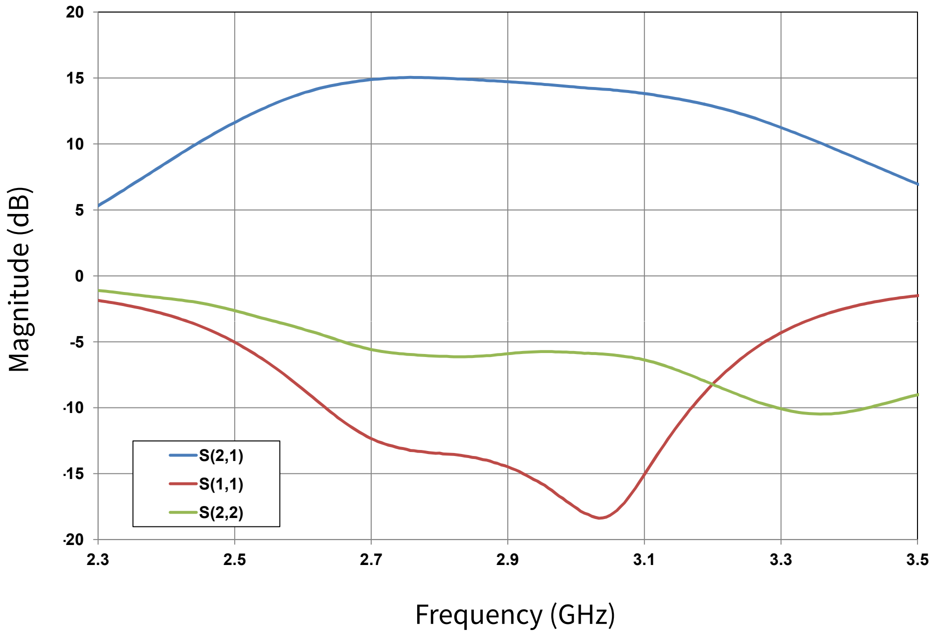
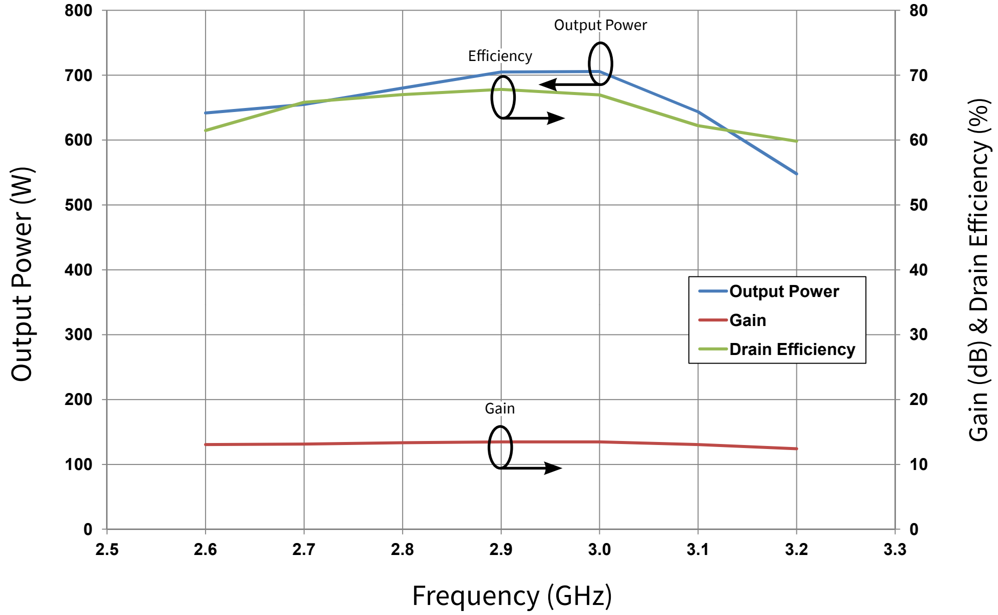


Figure 2. CGHV31500F Output Power and Drain Efficiency vs Frequency
V_{DD} = 50 V, I_{DQ} = 0.5 A, P_{IN} = 46 dBm, Pulse Width = 100µs, Duty Cycle = 10%, T_{CASE} = 25°C



Typical Performance

Figure 3. CGHV31500F Drain Efficiency & Gain vs. Input Power
V_{DD} = 50 V, I_{DQ} = 500 mA, Pulse Width = 100 us, Duty Cycle = 10%

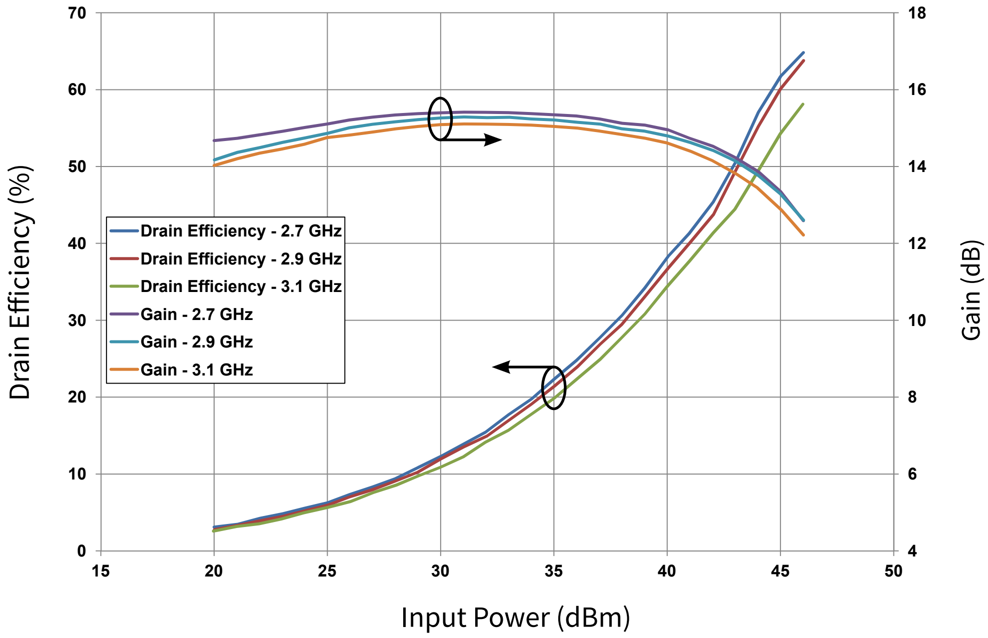
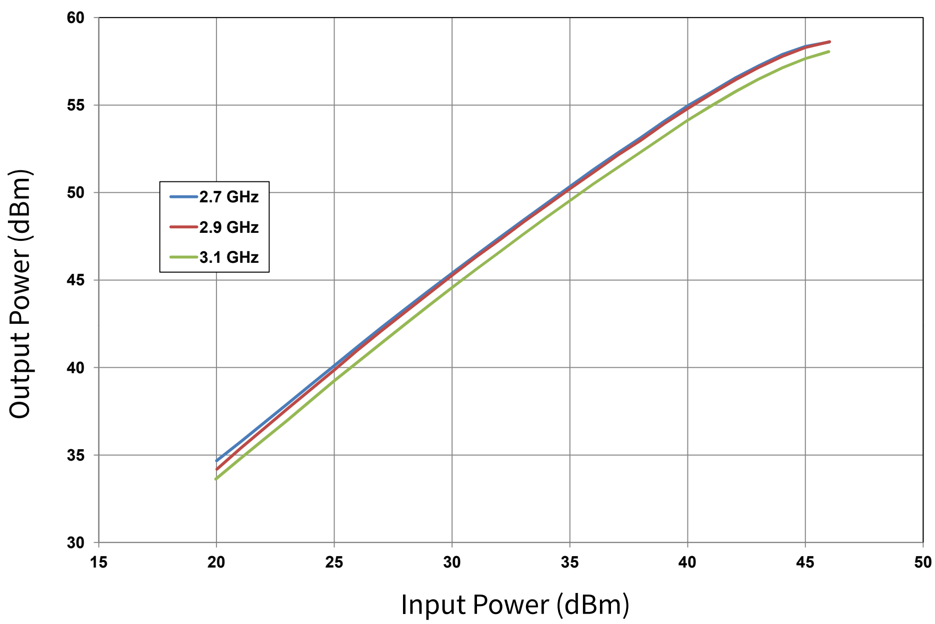


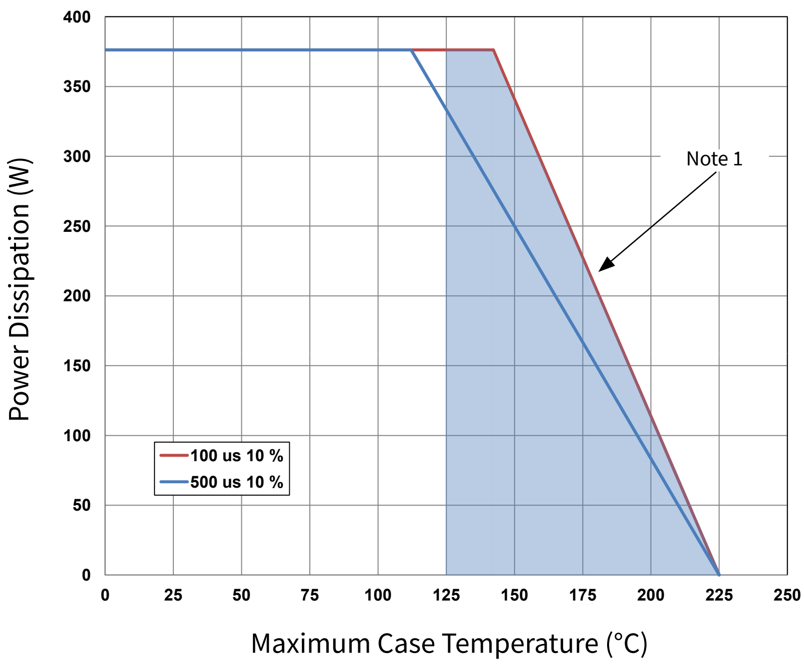
Figure 4. CGHV31500F Output Power vs. Input Power
V_{DD} = 50 V, I_{DQ} = 0.5 A, Pulse Width = 100µs, Duty Cycle = 10%, T_{CASE} = 25°C



CGHV31500F-AMP Application Circuit Bill of Materials

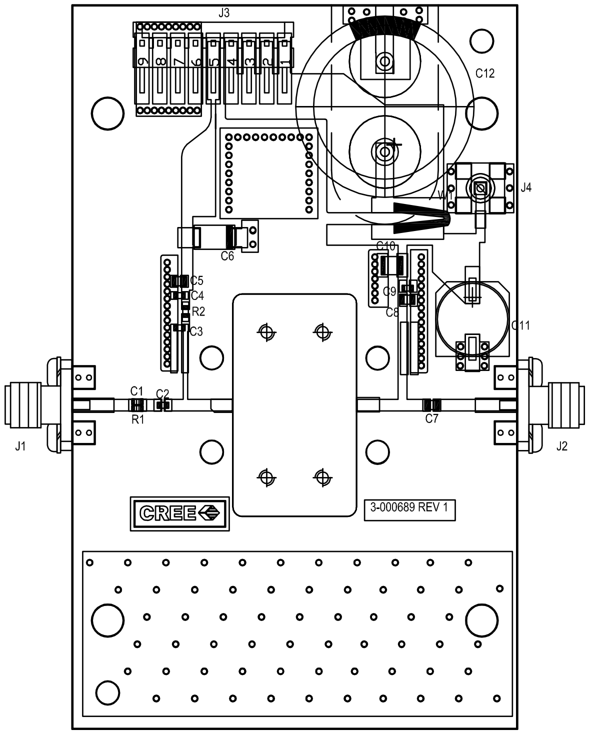
Designator	Description	Qty
R1	RES, 511, OHM, +/- 1%, 1/16W, 0603	1
R2	RES, 5.1, OHM, +/- 1%, 1/16W, 0603	1
C1	CAP, 6.8pF, +/-0.25%, 250V, 0603	1
C2, C7, C8	CAP, 10.0pF, +/-1%, 250V, 0805	3
C3	CAP, 10.0pF, +/-5%, 250V, 0603	1
C4, C9	CAP, 470pF, 5%, 100V, 0603, X	2
C5	CAP, 33000 pF, 0805, 100V, X7R	1
C6	CAP, 10uF 16V TANTALUM	1
C10	CAP, 1.0uF, 100V, 10%, X7R, 1210	1
C11	CAP, 33uF, 20%, G CASE	1
C12	CAP, 3300uF, +/-20%, 100V, ELECTROLYTIC	1
J1,J2	CONN, SMA, PANEL MOUNT JACK, FL	2
J3	HEADER, RT>PLZ, 0.1CEN LK 9POS	1
J4	CONNECTOR; SMB, Straight, JACK, SMD	1
W1	CABLE, 18 AWG, 4.2	1
-	PCB, RO4350, 2.5 X 4.0 X 0.030	1
Q1	CGHV31500F	1

CGHV31500F Power Dissipation De-rating Curve

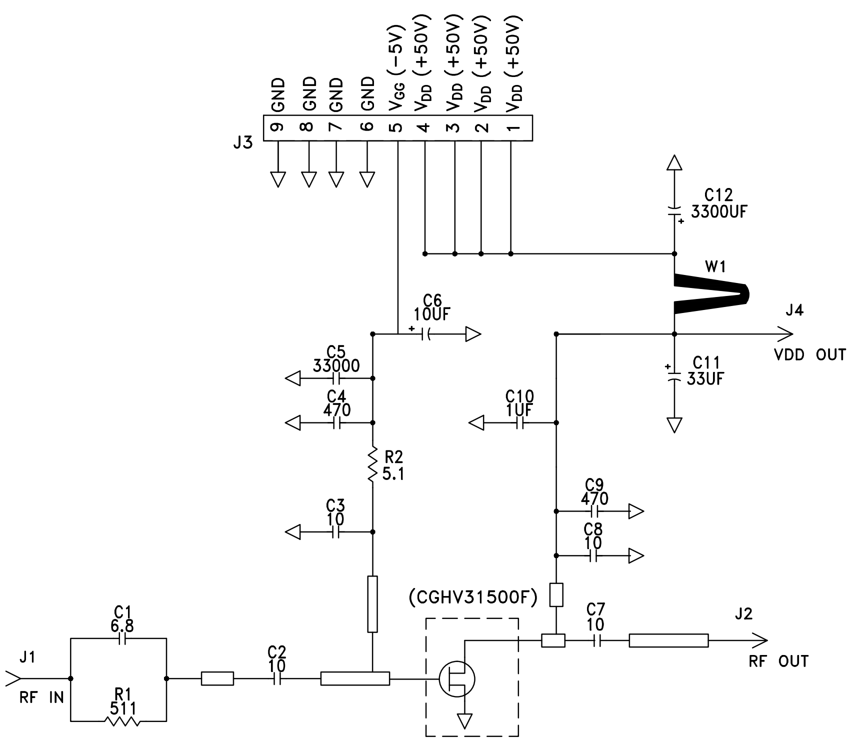


Note 1. Area exceeds Maximum Case Temperature (See Page 2).

CGHV31500F-AMP Application Circuit Outline



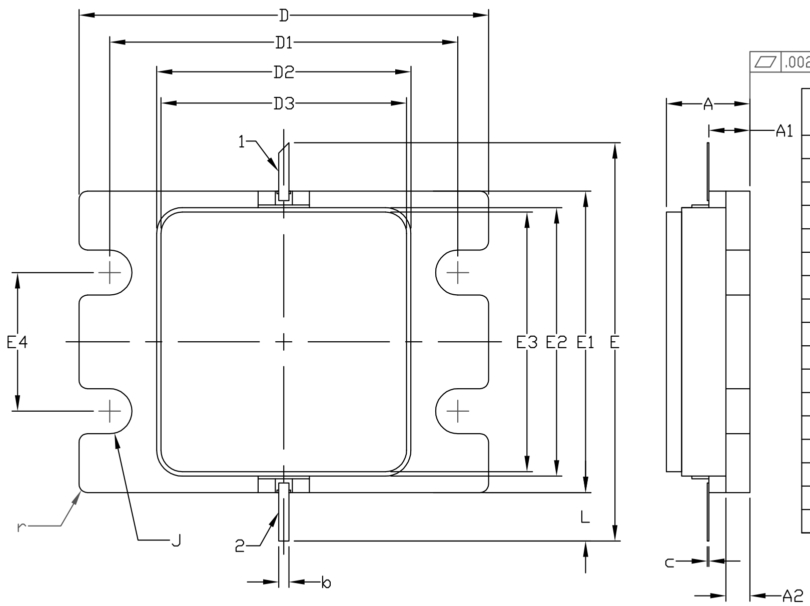
CGHV31500F-AMP Application Circuit Schematic



Product Dimensions CGHV31500F (Package Type — 440226)

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. INTERPRET DRAWING IN ACCORDANCE WITH ANSI Y14.5M-2009
2. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF .020 BEYOND EDGE OF LID
3. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF .008 IN ANY DIRECTION
4. ALL PLATED SURFACES ARE GOLD OVER NICKEL



1. GATE
2. DRAIN

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX	NOTES
A	0.185	0.201	4.70	5.11	
A1	0.088	0.100	2.24	2.54	2x
A2	0.049	0.061	1.24	1.55	
b	0.022	0.026	0.56	0.66	2x
c	0.003	0.006	0.08	0.15	
D	0.935	0.955	23.75	24.26	
D1	0.797	0.809	20.24	20.55	2x
D2	0.581	0.593	14.76	15.06	
D3	0.565	0.571	14.35	14.50	
E	0.906		23.01		REF
E1	0.679	0.691	17.25	17.55	
E2	0.604	0.616	15.34	15.65	
E3	0.588	0.594	14.93	15.09	
E4	0.309	0.321	7.85	8.15	2x
J	ø0.097	ø0.107	ø2.46	ø2.72	4x
L	0.090	0.130	2.29	3.30	2x
r	0.02 TYP		0.51 TYP		12x

Part Number System

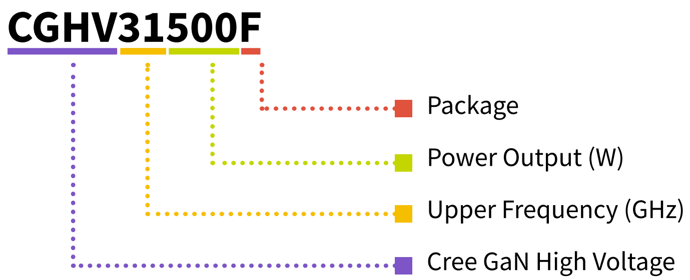


Table 1.

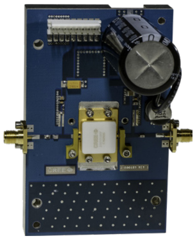
Parameter	Value	Units
Upper Frequency[1]	3.1	GHz
Power Output	500	W
Package	Flange	-

Note[1]: Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

Table 2.

Character Code	Code Value
A	0
B	1
C	2
D	3
E	4
F	5
G	6
H	7
J	8
K	9
Examples:	1A = 10.0 GHz 2H = 27.0 GHz

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV31500F	GaN HEMT	Each	
CGHV31500F-AMP	Test board with GaN HEMT installed	Each	

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Notes

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